

The Value of Enterprise Architecture

by Tony Brown

Introduction

I am sometimes asked to help people justify the cost of establishing an enterprise architecture (EA) program as a "return on investment." This is a tall order. I liken it to trying to justify the cost of an activity such as strategic planning. How do you quantify the value of activities that create knowledge, clarify thinking, aid in analysis and decision-making? Many don't even try, accepting that such activities can perhaps be carried out more efficiently but not eliminated entirely. So why is it so difficult for people to view EA in the same light?

One reason could be that most existing organizations were not architected formally to begin with, and they can probably continue to exist as they always have, at least in the short term. In other words, the urgency or the benefits of implementing an EA program may not be very evident. Another reason may be that most EA programs originate in IT organizations. If there is little or no understanding of EA by the enterprise's business executives then, as with IT projects, there is a natural tendency to ask for a business case analysis including an indication of savings or increased profit that might be expected from such an endeavour.

In his article, "You Can't 'Cost-Justify' Architecture," John Zachman makes the point that cost-justification for increased automation is an Industrial Age notion when computers were employed to do the same old things faster and cheaper than people could. That age is gone forever. Information Age concepts stimulate thinking about using automation technologies to do things that never could be done before, and enterprises that adapt to this reality will outperform (and outlive) those that don't. In this environment, architecture must be thought of not as a way of reducing other costs but as a strategic information asset to be used to shape and re-shape the enterprise at will.

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4. Increased agility by lowering the "complexity barrier";
5. Reduced solution delivery time and development costs by maximizing reuse of enterprise models; and
6. Ability to create and maintain a common vision of the future shared by both the business and IT communities, driving continuous business/IT alignment.

As will be seen, although the primary intention for implementing EA may not be to reduce costs, it can in fact provide some stunning returns on investment.

EA Value to Enterprises

(1) Readily available documentation of the enterprise

I first became aware of the importance of enterprise documentation when I worked in a headquarters organization that was responsible for the engineering and maintenance of military air traffic control systems in Canada and overseas. The documentation for every remote site included not only information about all of the electronic equipment, circuit diagrams, etc., but also "as-built" drawings and photographs of each installation. For any given site, we could pull out the drawings and see exactly where components were placed in any room. All air traffic control sites were under "configuration control," meaning no changes could be made to any installation without their going through a formal approval process. The "as-built" drawings were amended as changes were approved and implemented. Such tight management of the configuration of the air traffic control systems and documentation about them reduced the risk of unauthorized changes that might have safety implications. It also greatly reduced the time it took to make the authorized changes, as the engineers back at headquarters didn't have to start from scratch. A similar "configuration control" concept was applied to air traffic control policies and procedures.

The same disciplined approach to managing documentation may be found in all enterprises where influence over decisions and control of behaviour are considered essential to the safety, security and execution of the enterprise's mission. They wouldn't stay in business very long if they didn't take such an interest in recording "how things ought to be." (Think nuclear power plant.)

The benefits of enterprise documentation, or architecture, are not limited to cases where safety and security are on the line. They apply to any enterprise where stakeholders need to be able to "see" the enterprise not only as it is and but as it is envisioned to be, assuming its owners wish to bring about changes and need to communicate a common understanding of them to stakeholders who are not only affected by the changes but are also expected to participate in bringing them about. The value of EA in this regard is usually expressed in terms of its ability to serve as a thinking and communications tool, and as a tool for knowledge management and change management.

(2) Ability to unify and integrate business processes across the enterprise

This benefit is sometimes likened to putting marbles into a bucket to weed out the duplicate ones. In the same way that marbles of the same colour can be easily

identified and removed once collected together, so too can duplicate processes in different parts of an organization be identified by EA. You may not want to eliminate all duplicate processes, but you certainly should wish to integrate them by using common infrastructure to carry them out.

Case Study - NORAD²: At North American Aerospace Defense Command's underground combat operations centre at Cheyenne Mountain in Colorado Springs, Colorado, there were three aging legacy systems, each built and maintained by different program offices and using different equipment and software. After defining the processes involved it was then possible to do a side-by-side comparison, and a significant amount of overlap was found in the processes of each system. Each system involved monitoring the situation, assessing the situation, planning operations and executing operations. The legacy systems involved approximately 370 individual processes. After the redesign effort, which was enabled by the EA endeavour, the number of unique processes was lowered to about 80.

(3) Ability to unify and integrate data across the enterprise and to link with external partners

This benefit is often spoken of in terms of the ability to capture data once and to reuse it, as required, throughout the enterprise in different processes and applications. This saves time and money and greatly improves the ability of different applications to interoperate. Another benefit relates to workers being able to derive knowledge by relating sources of information in different parts of the enterprise, e.g., to answer a question such as which business processes are carried out by which people?

Achieving such an "integrated information environment" within and across enterprises, and eventually across extended enterprises, requires a top-down, disciplined approach to ensure consistent meaning of concepts across all of these jurisdictions. There is increasing pressure for government and commercial enterprises to consolidate or harmonize their services as much as possible. Some government interjurisdictional initiatives have already been undertaken to provide "one-stop-shop" service to meet the needs of citizens who don't care which level of government is providing which service. Architecting such "extended enterprises" by creating and maintaining descriptive representations of them helps not only in their initial design but also in the ability of the contributing partners to make any necessary changes as required. The impacts resulting from any change in one area are more readily discerned when a whole "extended business" is available for analysis.

Wal-Mart is the textbook success story on the commercial side of the coin with suppliers being kept informed through cash register transactions as to the shelf inventories on hand so that they know directly when to ship replacement items.

(4) Increased agility by lowering the "complexity barrier," an inhibitor of change

Some have described the enterprise as the most complex of concepts to understand fully. Other areas of knowledge typically are restricted to one kind of object, e.g.,

² Article, "Serious About Enterprise Architecture," by Joab Jackson, published in Washington Technology, February 18, 2002.

plants in the case of botany. Enterprises comprise, people, organizations, things, processes, goals, policies, rules, events, locations, and so on. For large organizations, it is impossible for people to retain and work with so many variables to bring about meaningful change unless information about them is documented through EA.

I had a discussion recently with an individual who works for a company that provides an online service for printing books, greeting cards, T-shirts, coffee mugs, etc. You send in what you want printed in the desired form and quantity; they carry out the order. The business was started by one man in 1999 and has grown to well over 100 employees by 2004. Very little knowledge about this highly automated enterprise has been made explicit. Most of it is locked in the owner's head, making it very hard for the staff to make changes to order entry and accounting rules, to add new product lines, to increase the capacity of the system to meet an exploding demand, etc. When the system is changed to meet a new requirement, errors often occur in unexpected places, greatly increasing the time to make changes. This company, which almost collapsed under the strain of online shopping last Christmas, is in dire need of architecture to help it become more agile and to help it survive.

(5) Reduced solution delivery time and development costs by maximizing reuse of enterprise models (descriptive representations of enterprise elements that are meant to be shared or standardized across the enterprise)

In the past, information systems have traditionally been designed and implemented, from scratch, on a case-by-case basis. In the absence of reference models for data, processes, technology, etc., designers on these projects would have to create their own models to meet specific business requirements. This in turn has resulted in "stovepipe" solutions that are not interoperable and are relatively expensive to maintain. Systems developed in an EA environment, on the other hand, tend to avoid these difficulties.

Over the longer term, monetary savings from the effective use of EA should greatly exceed the costs of an architecture program for the same reasons that standardized interchangeable parts have brought down the costs of building and maintaining automobiles. Intuitively there are bound to be economics-of-scale benefits of using well-designed, standardized, reusable parts (both logical and physical) on an enterprise-wide basis. Increasingly over time the EA fosters benefits such as reductions in development time, fewer project failures, and tighter linkage of applications to business needs.

Case Study - Ohio Bureau of Workers' Compensation³: Case studies illustrating this benefit are rare because, to be convincing, one must compare the time and cost to deliver the same IT solution under two different conditions: (1) architected from the top down; and (2) classical system design method. However, the State of Ohio's experience with the design and development of an information system to support its workers' compensation program in comparison with another (unnamed) state has been documented. This system makes payments for medical treatment, supplies and services rendered to an injured worker when such treatment is necessary.

³ From "Enterprise Architecture: Value Proposition," a presentation by John Zachman. Original data from Doug Erickson. Additional information provided by Janet Domrose, Assistant Director, Ohio Bureau of Workers' Compensation IT Applications.

The Ohio Bureau of Workers' Compensation information system was architected with reuse in mind. In the course of developing the original application, a Rates System, which was implemented in the fall of 2000, 594 entity types were created, many of which were reused in the development of the subsequent following systems:

- § Payment System – 690 entity types (reused 294)
 - § Retroactive Billing System – 228 entity types (reused 218)
 - § Health Care Provider System – 320 entity types (reused 179)⁴
- Total number of times original entity types were reused - 691

The same application was developed for another state using the same CASE tool⁵. In this case, however, a rigorous, top-down enterprise architecture method was not followed. Teams began development work using traditional systems analysis techniques (vs. enterprise analysis). The experiences of the two cases is summarized in the following table:

	State of Ohio	Different State
Original Application	Workers' Compensation Rates System	Workers' Compensation Rates System
CASE Tool	IEF/CoolGen	IEF/CoolGen
Methodology	Architected	Classic
Entity Types	594	300
Elapsed Time	3 years ⁶	12 years
Development Costs	\$3.5 million	\$42 million
Cost per Entity Type	\$5000	\$140,000

It is interesting to note that in the case of Ohio, the 691 times that entity types that were reused in the follow-on systems amounted to a cost avoidance of \$3,455,000 (691 x \$5000).

In addition, the Ohio State's Rates System includes 115 procedures (programs) and 1177 modules (callable actions from the programs). The 1177 modules are used 3112 times in the various procedures, giving a reuse factor of 2.64 (3112 ÷ 1177). This is attributed to the granularity and precision of the architected data model, with many processes being able to use the same data.

(6) Ability to create and maintain a common vision of the future shared by both the business and IT communities, driving continuous business/IT alignment

Aligning IT investments with business direction has long been recognized as an important principle in enterprise architecture. Before the Information Age, the motivation for business and IT alignment may have been primarily associated with reducing unnecessary expenditures. Today, however, the issue has a much greater

⁴ At the time of writing this system is not yet in production – only modeled.

⁵ Short for **Computer Aided Software Engineering tool**. CASE tools help automate, manage and simplify the system development process. This has been mentioned to indicate that the conditions for the two cases were virtually identical.

⁶ One year for start up/requirements/modeling sessions, etc., and two years for actual development.

significance because information systems can no longer be thought of just in terms of an enterprise's supporting technology, they define the enterprise. In other words, the System *is* the Enterprise.

The value of EA in this regard is that it forces the harmonious linking of strategic and business planning to business architecture, from business architecture to IT architecture, and from IT architecture to IT implementation. EA forces this because EA discipline requires all this knowledge to be made explicitly visible and to be used as a basis for approving IT investments.

Case Study – U.S. Federal Government: The U.S. Information Technology Management Reform Act of 1996, often referred to as the Clinger-Cohen Act, made it mandatory for all 116 of the U.S. federal departments and agencies to develop and use EA for IT investment planning and decision making. The most recent formal survey⁷ found that five agencies — the Environmental Protection Agency, the Labor Department, the National Science Foundation, the Office of Personnel Management, and the Federal Emergency Management Agency — had fully working architectures in place. The Environmental Protection Agency (EPA) now uses their EA to drive all IT investments and even includes unclassified versions of it on CD in contracts with vendors⁸ so that they may be better able to align their efforts with the envisioned future state for EPA.

Case Study – Volkswagen of America⁹: Volkswagen of America, following the Enterprise Architecture approach developed by Samuel Holcman of the Pinnacle Business Group, Inc., is a company of 2500 employees that imports VW, Audi and Bentley automobiles for the U.S. and Canadian markets. This company has been successful in implementing a top-down, business driven enterprise architecture that has led to:

- § Business support at the CEO level;
- § EA as being the recognized approach that drives both the business and technology strategies (corporate wide);
- § Business defining clear goals for the next five years and assigned business owners;
- § Alignment of budget planning and allocations with business goals;
- § Reorganization of people and departments based on EA analysis of functions and organizations;
- § The launch of a technology strategy and a related program of IT initiatives;

⁷ U.S. General Accounting Office Report to Congressional Committees, "Enterprise Architecture Use Across the Federal Government Can Be Improved," February 2002.

⁸ Article, "EPA puts architecture info in contracts," Sara Michael, Federal Computer Week, September 24, 2003.

⁹ Source: A presentation made at the Zachman Institute for Framework Advancement Forum by Edward Rybicki, November 2003.

- § The creation of a three year system retirement plan, providing the company with savings in operational expenses; and
- § The ability to prioritize technology projects based on business goals.

Conclusion

Six benefits of EA have been highlighted in this article in terms of the value they bring to specific enterprises. In some cases, EA value is financially quantifiable. The Ohio Workers' Compensation Bureau case study is a prime example of that, although it may be questioned based on the information provided if that is an example of excellent systems development rather than EA per se. In any event, it certainly is a good example of an "architected approach to systems development" in that system elements were designed from the start with re-use in mind.

Without doubt, the Volkswagen of America example is a model EA success story, reflecting the full, top-down value of EA to the enterprise. The specific points cited in the case study could perhaps serve as a benchmark for a fully mature EA program.

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